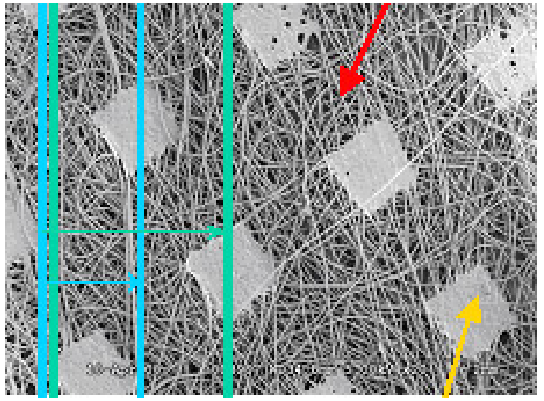
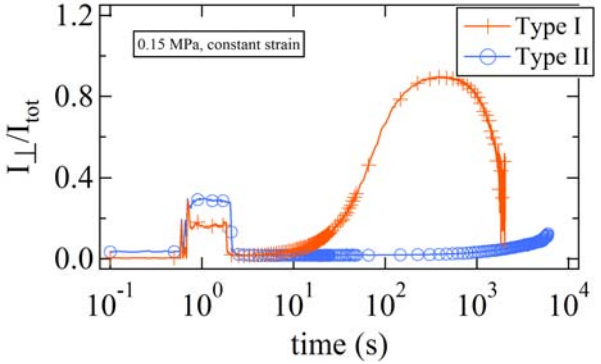
Making them Stretch without Breaking: Controlled Crystallization for Polyolefin Fabrics

Julie Kornfield, Caltech, DMR-0216491

Molecular insights from research at Caltech have been applied at Procter and Gamble to design polypropylene and polyethylene resins that provide superior elastomers. Dr. J.P. Autran at P&G created bimodal materials inspired by the binary blends studied by the Kornfield group. Seeking to suppress the formation of highly oriented crystals, which cause materials to be stiff and brittle, he blended long chains with low intrinsic crystallinity with short chains of high crystallinity. He proved that the resulting materials have improved extensibility and toughness, without sacrificing desirable processing characteristics. New nonwoven fabrics from these materials are currently in pilot scale production.



Nonwoven fabric consisting of a mat of fibers (red arrow) that are held together by thermal bond sites (yellow arrow).



Rheo-optical measurements at Caltech confirm that the improved P&G resins (blue) show reduced flow-induced oriented crystallization relative to conventional resins in which the longest chains are most crystallizable (orange).

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Education:
The graduate students pursuing research on flow induced crystallization of polymers (Derek Thurman and Lucia Fernandez-Ballaster) have learned about the competing demands imposed by processing and performance concerns. Meetings with Dr. J.P. Autran have shown Derek and Lucia how fundamental insights are applied in industry to simultaneously meet diverse performance criteria (e.g., processing characteristics, final material properties, cost).

Industrial Outreach:
Professor Kornfield has presented recent advances in understanding flow-induced crystallization to a diverse audience of resin producers and fabric manufacturers at the Polymer Community of Practice Conference sponsored by P&G (March 2004).

Technology Transfer:
Design principles emerging from our research have been translated into new P&G resins for non-woven fabrics that are currently in pilot-scale production. The resulting fabrics show improved drawability, durability (reduced “fuzz”) and excellent softness.